CLAIMS

1. A method of performing digital beam forming on the radiation pattern of an array antenna (34) comprising a plurality of antenna elements (34a-34c), each antenna element being coupled to a signal processing chain, said method comprising a weighting phase in which at least a complex weight coefficient (W_r, W_i) is applied to a digital signal in a corresponding signal processing chain, characterised in that said digital signal is an intermediate frequency digital signal (S_{IF}; S_{IF}^W), and in that said weighting phase comprises the following steps:

a) duplicating said digital signal into a first and a second digital signal;

b) processing said first and second digital signals by:

- multiplying (15, 17) said first and second digital signals respectively by a real (W_r) and an imaginary (W_i) part of said complex weight coefficient;
- applying a Hilbert transform (14) to that signal which is multiplied by the imaginary part (W_i) of said complex weight coefficient;

c) combining (18) said processed first and second digital signals into a weighted digital intermediate frequency signal (S_{IF}; S_{IF}^W) by subtracting said second signal from said first signal.

2. A method according to claim 1, wherein said step of applying the Hilbert transform (14) is performed before said step of multiplying (15, 17) said first and second digital signals by the real (W_r) and imaginary (W_i) parts of said complex weight coefficient.

3. A method according to claim 1 or 2, wherein said processing step comprises:

- delaying (14) said first signal, which is multiplied by the real part (W_r) of said complex weight coefficient, by a

predetermined time, in order to maintain such signal temporarily aligned with said second signal.

4. A method according to claim 3, wherein said step of applying a Hilbert transform (16) to said second signal and said step of delaying (14) said first signal are performed commonly to a plurality of intermediate frequency digital signals parallelly processed in corresponding signal processing chains.

5. A method according to claim 4, wherein said step of multiplying (15, 17) said first and second digital signals respectively by a real (W_r) and an imaginary (W_i) part of said complex weight coefficient is performed independently on the signal processing chain of each antenna element (34a-34c), using a corresponding weight coefficient (W_{rn}, W_{in}).

6. A system for performing digital beam forming on the radiation pattern of an array antenna (34), said array antenna comprising a plurality of antenna elements (34a-34c), each antenna element being adapted for being coupled to a signal processing chain suitable for applying to a digital signal at least a corresponding complex weight coefficient (W_r, W_i), characterised in that said digital signal is an intermediate frequency digital signal (S_{IF}; S_{IF}^W) and in that said system comprises:

- a first signal processing sub-chain (14, 15) operating on said intermediate frequency digital signal (S_{IF}; S_{IF}^W), comprising a first multiplier (15) for multiplying said intermediate frequency digital signal by a real (W_r) part of said complex weight coefficient;
- a second signal processing sub-chain (16, 17), operating in parallel with said first (14, 15) signal processing sub-chain on said intermediate frequency digital signal (S_{IF}; S_{IF}^W), comprising:

- a Hilbert transform block (16) for applying a Hilbert transform to said intermediate frequency digital signal;
- a second multiplier (17) for multiplying said intermediate frequency digital signal by an imaginary (W_i) part of said complex weight coefficient;

said Hilbert transform block (16) and said second multiplier (17) operating in cascade on said intermediate frequency digital signal;

- a subtracter (18) for subtracting the signal processed by said second signal processing sub-chain (16, 17) from the signal processed by said first signal processing sub-chain (14, 15), thus obtaining a weighted digital intermediate frequency signal (S_{IF}; S_{IF}^{W}).

7. A system according to claim 6, wherein said Hilbert transform block (16) processes said intermediate frequency digital signal before the same signal reaches said second multiplier (17).

8. A system according to claim 6, wherein said second multiplier (17) processes said intermediate frequency digital signal before the same signal reaches said Hilbert transform block (16).

9. A system according to claim 6, wherein said first (14, 15) signal processing sub-chain further comprises a delay block (14) operating in cascade with said first multiplier (15) on said intermediate frequency digital signal.

10. A system according to claim 9, wherein said delay block (14) processes said intermediate frequency digital signal before the same signal reaches said first multiplier (15).

11. A system according to claim 9, wherein said first multiplier (15) processes said intermediate frequency

digital signal before the same signal reaches said delay block (14).

12. A system according to claim 9, comprising a down-link beam forming module (30) comprising:

- a Hilbert transform block (64) shared among a plurality of second signal processing sub-chains;
- a delay block (62) shared among a plurality of first signal processing sub-chains;
- a splitter (66) for replicating output signals from said Hilbert transform block (64) and said delay block (62) and for feeding corresponding first and second multipliers in said plurality of first and second signal processing sub-chains;
- a plurality of subtracters (70a-70n) for subtracting the signal processed by each second signal processing sub-chain from the signal processed by a corresponding first signal processing sub-chain, thus obtaining a weighted digital intermediate frequency signal (S_{IF}^{W}).

13. A system according to claim 9, comprising an up-link beam forming module (50) comprising:

- a Hilbert transform block (74) shared among a plurality of second signal processing sub-chains;
- a delay block (72) shared among a plurality of first signal processing sub-chains;
- a first adder (76) for summing contributions from a plurality of first multipliers in said plurality of first signal processing sub-chains and for feeding said delay block (72);
- a second adder (77) for summing contributions from a plurality of second multipliers in said plurality of second signal processing sub-chains and for feeding said Hilbert transform block (74);

- a subtracter (80) for subtracting the signal processed by said Hilbert transform block (74) from the signal processed by said delay block (72), thus obtaining a weighted digital intermediate frequency signal (S_{IF}^{W}).

14. A base transceiver station (BTS) in a mobile communication network comprising a system (96) for performing digital beam forming on the radiation pattern of an array antenna, characterised in that said system is realised according to any of claims 6 to 13.

15. A base transceiver station (BTS) according to claim 14, comprising a central unit (90) and an antenna unit (93), said antenna unit (93) being connected to said central unit (90) by means of a link (97), wherein said system (96) for performing digital beam forming is located within said antenna unit (93).

16. A base transceiver station (BTS) according to claim 15, wherein said link (97) is an optical fibre cable.

17. A base transceiver station (BTS) according to claim 14, comprising a central unit (90) and an antenna unit (93), said antenna unit (93) being connected to said central unit (90) by means of a link (97), wherein said system (96) for performing digital beam forming is located within said central unit (90).

18. A computer program product loadable in the memory of at least one computer and including software code portions for performing the steps of any of claims 1 to 5.